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Plecotus rafinesquii.

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Plecotus É. Geoffroy Saint-Hilaire, 1818

Plecotus É. Geoffroy Saint-Hilaire, 1818:119. Type species *Vespertilio auritus* Linnaeus, 1758, by tautonomy.

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Family Vespertilionidae, Subfamily Vespertilioninae. The genus *Plecotus*, excluding *Idionycteris* (Williams *et al.*, 1970), contains five living species in two subgenera. The following key was modified from Handley (1959), Bauer (1960), and Stebbings (1967).

1 Supraorbital region sharply ridged ..... (*Plecotus*) 2
Supraorbital region not ridged; temporal ridges normally coalesced to form a sagittal crest ..... (*Corynorhinus*) 3

2 (1) Width of tragus less than 5.4 mm; length of upper canine (height of crown) less than 1.7 mm; dorsal pelage buff or gray; bases of hairs on venter dark brown or buff ..... *P. auritus*
Width of tragus greater than 5.4 mm; length of upper canine (height of crown) greater than 1.7 mm; dorsal pelage usually gray; bases of hairs on venter dark black ..... *P. austriacus*

3 (1) Tips of ventral hairs white or whitish, sharply contrasted with blackish bases; median postpalatal process triangular in shape, with a broad base; rostrum weak and much depressed; I1 with prominent secondary cusp; anterointernal cusp usually present on cingulum of P4 ..... *P. rafinesquii*
Tips of ventral hairs brownish or buff, often not sharply contrasted with slate, gray, or brownish bases; median postpalatal process usually styliform, with a narrow base (occasionally triangular); rostrum strong and not depressed, or variable; I1 with or without secondary cusp; anterointernal cusp absent or variable on cingulum of P4 4

4 (3) Coloration of dorsum dark sooty-brown, with scant contrast between bases and tips of hairs; greatest length of skull usually less than 15.7 mm (females) or 15.5 mm (males); maxillary toothrow usually less than 4.9 mm; I1 usually with secondary cusp; tragus usually less than 13 mm long; interfemoral cross ribs usually less than nine ..... *P. mexicanus*
Coloration of dorsum sometimes yellow-brown, with sharp contrast between bases and tips of hairs; greatest length of skull usually more than 15.7 mm (females), or 15.5 mm (males); maxillary toothrow usually more than 4.9 mm; I1 usually simple; tragus usually more than 13 mm long; interfemoral cross ribs usually more than nine ..... *P. townsendii*

Plecotus rafinesquii Lesson, 1827

Vespertilio megalotis Rafinesque, 1818:446; preoccupied, renamed by Lesson, 1827:96.

Plecotus rafinesquii Lesson, 1827:96, see below.

Plec[*otus*] *macrotis* Le Conte, 1831:431, see below.

CONTEXT AND CONTENT. Context given in the generic summary above. Two subspecies are recognized (Handley, 1959) as follows:

P. r. macrotis Le Conte, 1831:431. Type locality not designated, but subsequently fixed near the Le Conte Plantation, 5 mi. S Riceboro, Liberty Co., Georgia (Miller, 1897).

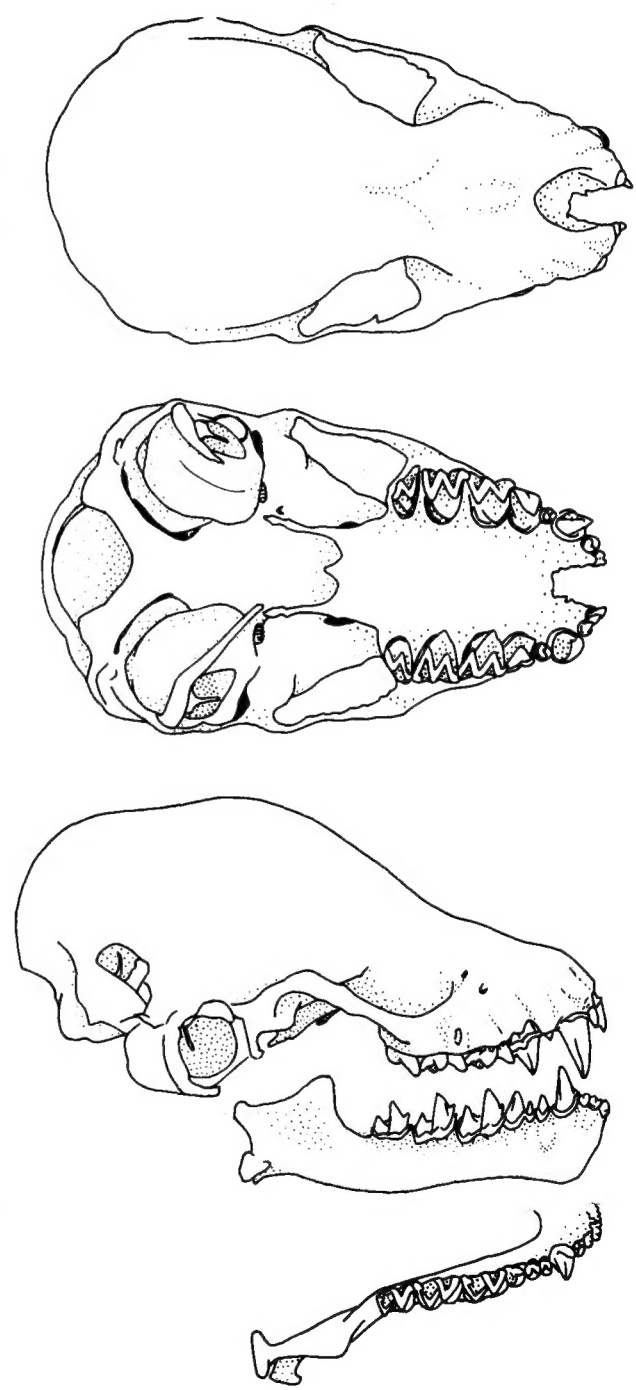

FIGURE 1. Skull and mandible of *Plecotus rafinesquii* (USNM 136101), from top to bottom: dorsal view, ventral view, side view of skull and mandible, and occlusal view of mandible. Drawn by Wilma Martin.

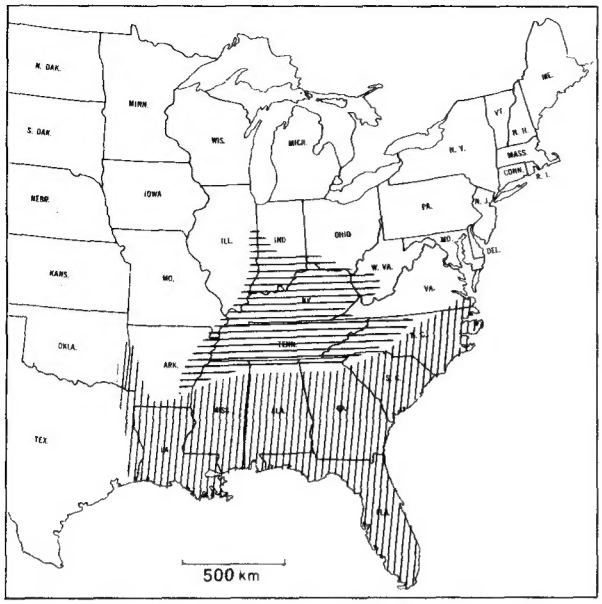

FIGURE 2. Distribution of *Plecotus rafinesquii macrotis* (vertical lines) and *Plecotus rafinesquii rafinesquii* (horizontal lines) modified from Handley (1959) and Barbour and Davis (1969).

P. r. rafinesquii Lesson, 1827:96. Type locality the lower parts of the Ohio River, either in southern Indiana and Illinois or in western Kentucky somewhere between the Wabash and Green rivers, but subsequently restricted to Mount Carmel, Wabash Co., Illinois (Handley, 1959).

DIAGNOSIS. Color of pelage apparently is the most useful characteristic for distinguishing *P. rafinesquii* from geographically adjacent taxa of the genus. In *P. rafinesquii*, the bases of the ventral hairs are black or blackish and the tips are white or whitish, with considerable contrast between the two colors. In *P. townsendii*, the bases of the ventral hairs are gray or brownish and the tips are brown or buff, with slight contrast between the colors. The I1 of *P. rafinesquii* is bifid, whereas the I1 of *P. townsendii* is usually simple, except in *P. t. ingens*. *Plecotus rafinesquii* is similar in many respects to *P. mexicanus*. According to Handley (1959), *P. rafinesquii* is the most primitive living member of the subgenus *Corynorhinus*.

GENERAL CHARACTERS. Measurements in millimeters are: total length, 80 to 110; length of tail, 42 to 54; length of hind foot, 8 to 13; length of ear, 27 to 37; length of forearm, 38.8 to 43.5; length of third metacarpal, 35.7 to 39.5; greatest length of skull, 13.2 to 15.1; depth of cranium, 5.6 to 6.4; breadth of cranium, 8.2 to 9.1; breadth of zygomata, 8.2 to 8.9; breadth of interorbital constriction, 3.5 to 4.0; breadth of palate, 5.8 to 6.4; length of palate, 4.9 to 5.4; length of maxillary toothrow, 4.7 to 5.4. Weights in grams are 7.9 to 9.5 in males and 7.9 to 13.6 in females. Measurements and weights are from Handley (1959), Lowery (1974), Barbour and Davis (1974), and Jones and Suttkus (1975). Other than in weight, there is little, if any, sexual dimorphism in size. The skull is illustrated in Figure 1. Black and white, as well as color, photographs of this species are in Barbour and Davis (1969, 1974). A photograph of this bat in flight appears in Lowery (1974).

DISTRIBUTION. This species occurs from southern Virginia westward and northward to central Indiana, southward and westward to southeastern Oklahoma and eastern Texas, and southward along the Atlantic Coast to Florida and westward along the Gulf Coast (Hall and Kelson, 1959; Handley, 1959; Barbour and Davis, 1969). The general ranges of the species and its subspecies are depicted in Figure 2. Local distributional patterns in many areas are imperfectly known, especially in Kentucky (Fessler, 1971; Barbour and Davis, 1974), in the southwestern portion of the range (Michael and Birch, 1967; Baker and Ward, 1967; Lowery, 1974), and along the Gulf Coast and in Florida (Handley, 1959; Hall and Kelson, 1959). The species occurs in nearly every forest association throughout most of the Austroriparian and much of the Carolinian biotic provinces of the southeastern United States (Dice, 1943).

FOSSIL RECORD. There is no fossil record for *P. rafinesquii*. However, two Pleistocene species are known from North America. *Plecotus alleganiensis* Gidley and Gazin, 1933:345, known only from the Pleistocene fauna of Cumberland Cave, Maryland, apparently is closely related to *P. rafinesquii* and *P. townsendii* (Handley, 1959). *Plecotus tetralophodon* Handley, 1955:48, known only from the Pleistocene fauna of San Josecito Cave, Nuevo León, México, is not closely related to the Recent species.

For a discussion of the evolutionary trends of teeth of *Plecotus* and relationships to other fossil Chiroptera, see the work by Slaughter (1970).

FORM. Detailed studies have not been made of most systems of *P. rafinesquii*. Some descriptions, drawings, and nomenclature of teeth were provided by Handley (1959), who also described and compared several selected external, cranial, and skeletal characteristics of the species in this genus. Some dimensions of wings and limited information on flight in this species are available; wing areas (cm^2) for adult *P. rafinesquii* average 112.84 (100.62 to 127.19), and wing loadings (g/cm^2) average 0.069 (0.057 to 0.077). These values for wing areas are smaller than similar figures for *P. townsendii*; however, wing loadings are similar for *P. rafinesquii* and *P. townsendii* (Jones and Suttkus, 1971; Farney and Fleharty, 1969). For a discussion of the morphologic properties of bat wings, see the work by Findley *et al.* (1972). Hamilton (1949) described and illustrated the baculum of *P. r. macrotis*. The sperm of this taxon was described and sketched by Hirth (1960). Measurements in microns are: length of head, 3.8 (3.7 to 4.0); width of head, 1.9 (1.7 to 2.0); length of midpiece, 8.9 (8.5 to 9.5); width of midpiece, 1.1 (0.9 to 1.3); total tail length, 50.0 (46.1 to 57.3); tail/head, 13.2; tail/midpiece, 5.6.

The general form of *P. rafinesquii* is similar to that of *P. townsendii*, which is fairly well described in the literature.

FUNCTION. Data on seasonal changes in weight were summarized by Jones and Suttkus (1975). Mean weights of females generally are greater than those of males. There are few changes in weights of males throughout the year, except for slight increases in autumn. Females are heavy in spring, lose weight in summer, and gain weight in autumn.

McNab (1974) computed relationships between body weights of bats and environmental temperatures in caves where bats hibernated. *Plecotus rafinesquii* was found hibernating at ambient temperatures colder than expected from body weight (Pearson, 1962; McNab, 1974).

ONTOGENY AND REPRODUCTION. Copulation apparently takes place in autumn and winter (Hoffmeister and Goodpaster, 1963; Barbour and Davis, 1969). Information is lacking with regard to fertilization and implantation; the precise gestation period is not known.

Few data are available on prenatal growth in this species. Lengths of forearms of embryos range from 18 to 38 per cent of the mean forearm lengths of newborn bats (Jones and Suttkus, 1975).

Females give birth to a single young in late May and early June. Parturition occurs a few days earlier in the southern part of the geographic range than in the northern portions of the range (Barbour and Davis, 1969).

Young bats are closely associated with adult females for about three weeks after parturition, at which time the young become competent at flight and have permanent dentition. For additional discussion of the development of flight in young *P. rafinesquii* and for descriptions of lacteal dentition and tooth replacement, see the works by Jones and Suttkus (1971, 1975). Recorded weights of neonates range from 2.3 to 2.6 grams. At one month of age, young bats weigh approximately the same as adult animals. Newborn animals are naked. A dark juvenal pelage develops within a few days after birth and prevails until young bats are about three months old, when molt to adult pelage occurs (Handley, 1959; Jones and Suttkus, 1975). Forearms of young bats increase in length by about 40 per cent during the first month after birth when these measurements become similar to those of adults.

Adult males with enlarged testes and sperm in the epididymides were reported in January by Layne (1958) and Handley (1959). Animals with swollen testes were found also in August (Hall, 1963).

A female with a life span of at least 10 years and 1 month was reported by Paradiso and Greenhall (1967). Some marked animals remained in a colony in Louisiana for eight years (Jones and Suttkus, 1975).

ECOLOGY. Some aspects of the ecology, especially colony structure, of *P. rafinesquii* were studied by Jones and Suttkus (1975). In most colonies, females greatly outnumber males. However, no significant differences in sex ratios of the total population were noticed during a nine-year study of a colony in southern Louisiana. Long-term residents of this colony from year to year were mostly males; adult and young females emigrated from this colony more than did adult and young males.

Roosting sites utilized most frequently by this species throughout its geographic range are partially lighted, mostly unoccupied buildings and other man-made structures. Also, these bats roost in caves, trees, and other natural places, especially in the northern parts of the range (Barbour and Davis, 1969).

Colonies of *P. rafinesquii* range in size from several animals to about 100 individuals. Colonies in the northern part of the range are generally larger than those in the south. The influence of cave temperatures on sizes of clusters of bats was discussed by McNab (1974), who predicted that cluster size within a species would vary inversely with cave temperatures.

Throughout its geographic range, *P. rafinesquii* frequently roosts with *Pipistrellus subflavus*. In the southern part of its range, *P. rafinesquii* is found sometimes with *Myotis austroriparius*, and in the north *P. rafinesquii* and *P. townsendii* occasionally share the same caves. Rarely, other species, such as *M. grisescens, M. leibii, M. keenii, M. lucifugus, M. sodalis,* and *Eptesicus fuscus* may be found roosting near *P. rafinesquii*. In Louisiana where *M. austroriparius* and *P. subflavus* use the same roosts as *P. rafinesquii*, it is found either in clusters or in different places in the roosts separated from the other species (Jones and Suttkus, 1975).

Several snakes (*Elaphe guttata, Crotalus adamanteus, Ancistrodon piscivorus*) were found in roosting sites in Louisiana, and may occasionally feed on the bats. Other potential predators are raccoons, opossums, and cats. Because of its roosting habits, *P. rafinesquii* is highly susceptible to predation and other disturbances by man.

BEHAVIOR. *Plecotus rafinesquii* roosts in clusters of various sizes (two to ± 100) and singly. A solitary animal hangs either as a pendant or with the ventral surface against the substrate.

During summer, roosting animals are usually active and capable of immediate flight. When disturbed, they begin to move their ears and usually turn the head as if looking about. During winter, and occasionally in summer, the bats hang with the ears coiled alongside of the head; usually the ears are between the head and the folded wings. When disturbed while in this position during rest or torpor, several minutes may be required for the animals to arouse and erect the ears.

These bats emerge from the roosts after dark, and return to the resting site prior to dawn. Apparently this species does not forage in twilight.

The flight of adults varies from swift to nearly hovering, and is quite agile. Adult females disturbed from maternal colonies will fly with young animals attached; however, there is no evidence that young bats are carried by adults while foraging. Young *P. rafinesquii* at estimated ages of 15 to 18 days are capable of straightline, non-agile flight, and usually land with the head up (Jones and Suttkus, 1971).

Data on frequencies of recaptures of *P. rafinesquii* at a colony in southern Louisiana and a colony in southwestern Mississippi were presented by Jones and Suttkus (1975). At these colonies, 56.0 per cent and 74.6 per cent, respectively, of the animals marked were recaptured at least one time. More females than males were recaptured, apparently a reflection of maternal behavior.

Within a roosting area, these bats move frequently both in summer and winter (Barbour and Davis, 1969; Jones and Suttkus, 1975). There are tendencies for the bats to roost in specific places within the areas available. No differences between sexes are apparent with regard to roost specificities. Movements and clustering of *P. rafinesquii* within roosts are correlated with air temperatures (Hoffmeister and Goodpaster, 1963; Jones and Suttkus, 1975; McNab, 1974).

Plecotus rafinesquii is a hibernating species, but the time when hibernation takes place is not clear. Hibernating individuals are found throughout the winter in the northern part of the range. Of all of these bats seen from December to May in southern Louisiana, 20 per cent were in torpor.

This species may become torpid during the summer months. Of all animals observed in southern Louisiana between June and November, three per cent were in torpor.

GENETICS. The diploid number of chromosomes in *P. rafinesquii* is 32, and the fundamental number of arms of the autosomes is 50. There are 10 pairs of metacentric and five pairs of acrocentric chromosomes. The X and Y chromosomes are acrocentric (Baker and Mascarello, 1969). The diploid number is lower than that of numerous other bats. For reported chiropteran karyotypes, the mean diploid number is 36.8, and the mean fundamental number is 51.6 (Baker, 1970). The karyotype of *P. rafinesquii* is identical to that of *P. townsendii* (Baker and Mascarello, 1969). Comparisons of the karyotypes of all plecotine bats were presented by Williams *et al.* (1970).

REMARKS. Vernacular names that appear in the literature include Rafinesque's big-eared bat, eastern big-eared bat, southeastern big-eared bat, eastern lump-nosed bat, and eastern long-eared bat. The name used most frequently is Rafinesque's big-eared bat (Jones *et al.*, 1973).

A zone of integradation between the two subspecies of *P. rafinesquii* was depicted by Handley (1959). For information on the intermediate specimens, see the discussions by Handley (1959) and Lowery (1974).

Because of nomenclatorial changes during the past two decades, there is considerable confusion in the literature regarding *P. rafinesquii* and its relatives in the New World. Much of what has been written on this species is based on inferences and extrapolations from what is known about *P. townsendii*.

ETYMOLOGY. The generic name is derived from the Greek word *pleko* and the Latin word *otus*, which refer to the twisted ear. The species name refers to the French explorer and naturalist, C. S. Rafinesque, who traveled and studied wildlife in the United States in the early 1800's.

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